Report to

MID-AMERICA STEEL DRUM COMPANY, INC
Oak Creek, WI Facility (FID 241021220)

for

PARTICULATE & VOC AIR EMISSIONS TESTING

of

DRUM RECLAMATION FURNACE (P30) &
AFTERBURNER OPERATIONS (C30)

June 6, 2014

ETE

Report to

MID-AMERICA STEEL DRUM COMPANY, INC
Oak Creek, WI Facility (FID 241021220)

for

PARTICULATE & VOC AIR EMISSIONS TESTING

of

DRUM RECLAMATION FURNACE (P30) &
AFTERBURNER OPERATIONS (C30)

June 6, 2014

Michael J. Huenink
Industrial Hygienist
July 2, 2014

ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORP
13000 W. Bluemound Road Elm Grove, Wisconsin 53122
Phone: (262) 784-2434 Fax: (262) 784 -2436

EXECUTIVE SUMMARY

On June 6, 2014, Environmental Technology & Engineering Corp (ETE) personnel visited the Mid-American Steel Drum Company facility (FID No. 241021220) located at 8570 South Chicago Road in Oak Creek, Wisconsin. The purpose of the visit was to perform air emissions testing on the Drum Reclamation Furnace Operation and its associated afterburner control device. This testing was requested by the Region 5 office of the US EPA in a letter dated March 5, 2014. Specifically, testing to determine total particulate emissions and the afterburner destruction efficiency of volatile organic compounds (VOCs) was requested. Testing was performed to address the EPA's request. The test results from this effort are compared to Wisconsin Department of Natural Resources (WDNR) Air Pollution Control Permit No. 241021220-P20 (P30, C30, S10), the document which includes the current emission limitations that have been assigned to these operations.

The results of the particulate testing indicated that the total particulate emissions were below (in compliance with) the WDNR permit limitations. The particulate test results can be summarized as follows:

Stack Tested	Test Date	Test	Total Particulate Emission Concentration	Total Particulate Emission Rate
S10 (Final Stack)	6/6	1	0.0087 gr/dscf	2.91 lb/hr
		2	0.0065 gr/dscf	2.11 lb/hr
		3	0.0057 gr/dscf	1.86 lb/hr
		AVG	**0.0070 gr/dscf**	**2.29 lb/hr**
WDNR Permit Limit -				**3.3 lb/hr**

Notes: **gr/dscf** means grains of total particulate per dry standard cubic foot of exhaust gas
lb/hr means pounds per hour

The results of the volatile organic compound (VOC) testing indicated that the VOC destruction efficiency of the afterburner was above (in compliance with) the WDNR permit limitations:

Stack Tested	Test Date	Test	VOC Concen. into Afterburner	VOC Concen. from Afterburner	VOC Destruction Efficiency
C30 (Afterburner)	6/6	1	32.2 mg/m3 (as C)	1.0 mg/m3 (as C)	96.95 %
		2	44.5 mg/m3 (as C)	0.5 mg/m3 (as C)	98.78 %
		3	36.5 mg/m3 (as C)	0.5 mg/m3 (as C)	98.54 %
		AVG			**98.09 %**
			WDNR Permit Limit for VOCs -		**85 %**

Notes: **mg/m3 (as C)** means milligrams of total gaseous non-methane organics per dry standard cubic meter of exhaust gas, reported as carbon (as noted in EPA Method 25A)

1.0 GENERAL

On June 6, 2014, Environmental Technology & Engineering Corp (ETE) personnel visited the Mid-American Steel Drum Company facility (FID No. 241021220) located at 8570 South Chicago Road in Oak Creek, Wisconsin. The purpose of the visit was to perform air emissions testing on the Drum Reclamation Furnace Operation and its associated afterburner control device. This testing was requested by the Region 5 office of the US EPA in a letter dated March 5, 2014. Specifically, testing to determine total particulate emissions and the afterburner destruction efficiency of volatile organic compounds (VOCs) was requested.

The test efforts (and results included in this report) were performed to address the EPA's request. The test results are compared to Wisconsin Department of Natural Resources (WDNR) Air Pollution Control Permit No. 241021220-P20 (P30, C30, S10), the document which includes the current emission limitations that have been assigned to these operations:

Particulate matter (including condensables) -	3.3 lb/hr
VOCs -	85% (or greater) control

The Mid-America Steel Drum Company (MASD) is involved in the reclamation and refurbishing of industrial steel drums. The operations (P30) targeted in this inquiry were the Drum Reclamation Furnace (Balboa Pacific), installed in 1995. The unit consists of a mechanical conveyor belt, combustion chamber and afterburner (C30). The combustion chamber and afterburner are both natural gas-fired. The combustion chamber is equipped with 12 burners, while the afterburner is equipped with 4 burners. The combined fuel burning capacity of the combustion chamber is 19.5 mmBtu/hr, while the combined fuel burning capacity of the afterburner is 6.5 mmBtu/hr. In addition to an afterburner, the entrance to the combustion chamber is equipped with a steam curtain. The exhaust ventilation system to the furnace is constructed so part of the exhaust stream, after the afterburner, can be diverted to a nearby boiler (Waste Heat Boiler). During the test efforts, the boiler was taken off-line (no exhaust gas was diverted to it) so that all of the afterburner exhaust was vented through the final stack (S10).

Drums are fed through the reclamation furnace "single file" at an average rate of 200 drums per hour. Since the amount of residual material in the drums varies, operators continually select the drums to be processed in order to achieve a relatively constant level of waste material through the process. During the test efforts, every effort was made to maintain a drum processing rate at, or above, the average drum processing rate. The drum counts during each test were as follows:

Test 1 - 247 drums per hour
Test 2 - 225 drums per hour
Test 3 - 255 drums per hour

1.0 GENERAL (continued)

The furnace was operated at an internal temperature of 1300-1400 °F, typical of normal operation. The afterburner was operated at a combustion zone setpoint of 1700 °F (permit requirements have the minimum setpoint limit of 1650 °F). A strip chart of the afterburner temperatures is included in Appendix A of this report.

Mr. Scott Swosinski of MASD and Ms. Amy Litscher of Saga Environmental & Engineering (environmental consultant) facilitated in the coordination of the production activities and field test efforts. Mr. Dakota Prentice of US EPA - Region 5, as well as Messrs. Michael Griffin and Ryan Bergh of the WDNR - Southeast Region received and reviewed the stack test notification protocol. The field test and analytical efforts were performed by ETE personnel; Michael Huenink was the test team leader.

2.0 RESULTS

2.1 Particulate Matter Results

Testing to determine particulate emissions was performed isokinetically using EPA Method 5 and 202 (back-half analysis procedures for condensable particulates). A brief description of the methodology is included in Section 3.1 of this report. A sketch showing the sampling port and point locations on the final discharge stack is included as Figure 2-1.

Three separate 60 minute tests were performed; the detailed total particulate emission results are included as Tables 2-1 through 2-3. **The results of the particulate testing indicated that the total particulate emissions were below (in compliance with) the WDNR permit limitations.** The particulate test results can be summarized as follows:

Stack Tested	Test Date	Test	Total Particulate Emission Concentration	Total Particulate Emission Rate
S10 (Final Stack)	6/6	1	0.0087 gr/dscf	2.91 lb/hr
		2	0.0065 gr/dscf	2.11 lb/hr
		3	0.0057 gr/dscf	1.86 lb/hr
		AVG	**0.0070 gr/dscf**	**2.29 lb/hr**
WDNR Permit Limit -				**3.3 lb/hr**

Notes: **gr/dscf** means grains of total particulate per dry standard cubic foot of exhaust gas
lb/hr means pounds per hour

It might be noted that a larger probe sampling tip was utilized for the second and third tests, as compared to the first test. At the end of the first test, it was realized that a larger probe tip could be utilized in the testing, allowing for larger sample volumes. The decision was made to use a larger probe tip in order to minimize the impact of blank values and improve detection levels. All three tests had a sample volume greater than 30 cubic feet, meeting that criteria outlined in EPA Method 5.

2.2 VOC Results

Testing to determine VOC levels was performed using EPA Method 25A; a brief description of the methodology is included in Section 3.2 of this report. A sketch showing the sampling locations on the afterburner inlet duct and discharge end is included as Figure 2-2.

As noted in the test notification, the sampling locations immediately before and after the afterburner did not meet the EPA Method 2 criteria for proper location of air flow measurement (see attached sketch). Further, additional outside air is drawn into the final exhaust stack, following the afterburner, which would prevent that test location from being utilized for VOC destruction efficiency determination. For that reason, it was

2.2 VOC Results (continued)

proposed that the concentration of VOCs at each afterburner test location be used to determine the VOC destruction efficiency of the afterburner.

Static pressure measurements at the inlet and outlet of the drum reclamation furnace were made to verify that the operation remained negative to the outside air from a ventilation standpoint. Those readings indicated static pressures at the ends of the drum reclamation furnace that were 0.2 to 0.4 inches negative, relative to the outside air. Therefore, the capture efficiency of the furnace was assumed to be 100 percent and the control efficiency of the afterburner was then interpreted to be the same as the VOC destruction efficiency.

Testing was performed for three separate 60 minute test periods. The detailed results are included in Tables 2-4 through 2-6. **The results of the VOC testing indicated that the VOC destruction efficiency of the afterburner was above (in compliance with) the WDNR permit limitations:**

Stack Tested	Test Date	Test	VOC Concen. into Afterburner	VOC Concen. from Afterburner	VOC Destruction Efficiency
C30 (Afterburner)	6/6	1	32.2 mg/m3 (as C)	1.0 mg/m3 (as C)	96.95 %
		2	44.5 mg/m3 (as C)	0.5 mg/m3 (as C)	98.78 %
		3	36.5 mg/m3 (as C)	0.5 mg/m3 (as C)	98.54 %
		AVG			**98.09 %**
			WDNR Permit Limit for VOCs -		**85 %**

Notes: **mg/m3 (as C)** means milligrams of total gaseous non-methane organics per dry standard cubic meter of exhaust gas, reported as carbon (as noted in EPA Method 25A)

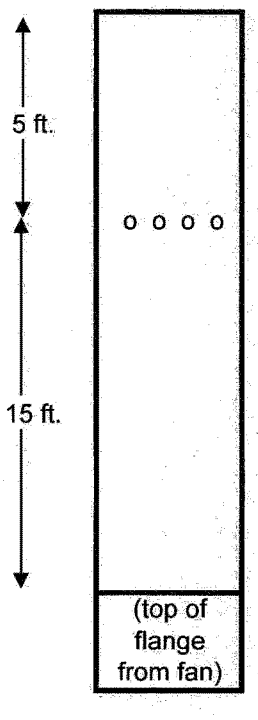
MID-AMERICA STEEL DRUM
FINAL STACK S10 - DRUM RECLAMATION OPERATIONS

FIGURE 2-1

SAMPLE POINT LOCATIONS

Point	Distance from back wall (in.)
1	4.5
2	13.5
3	22.5
4	31.5
5	40.5
6	49.5

SAMPLE PORT LOCATION

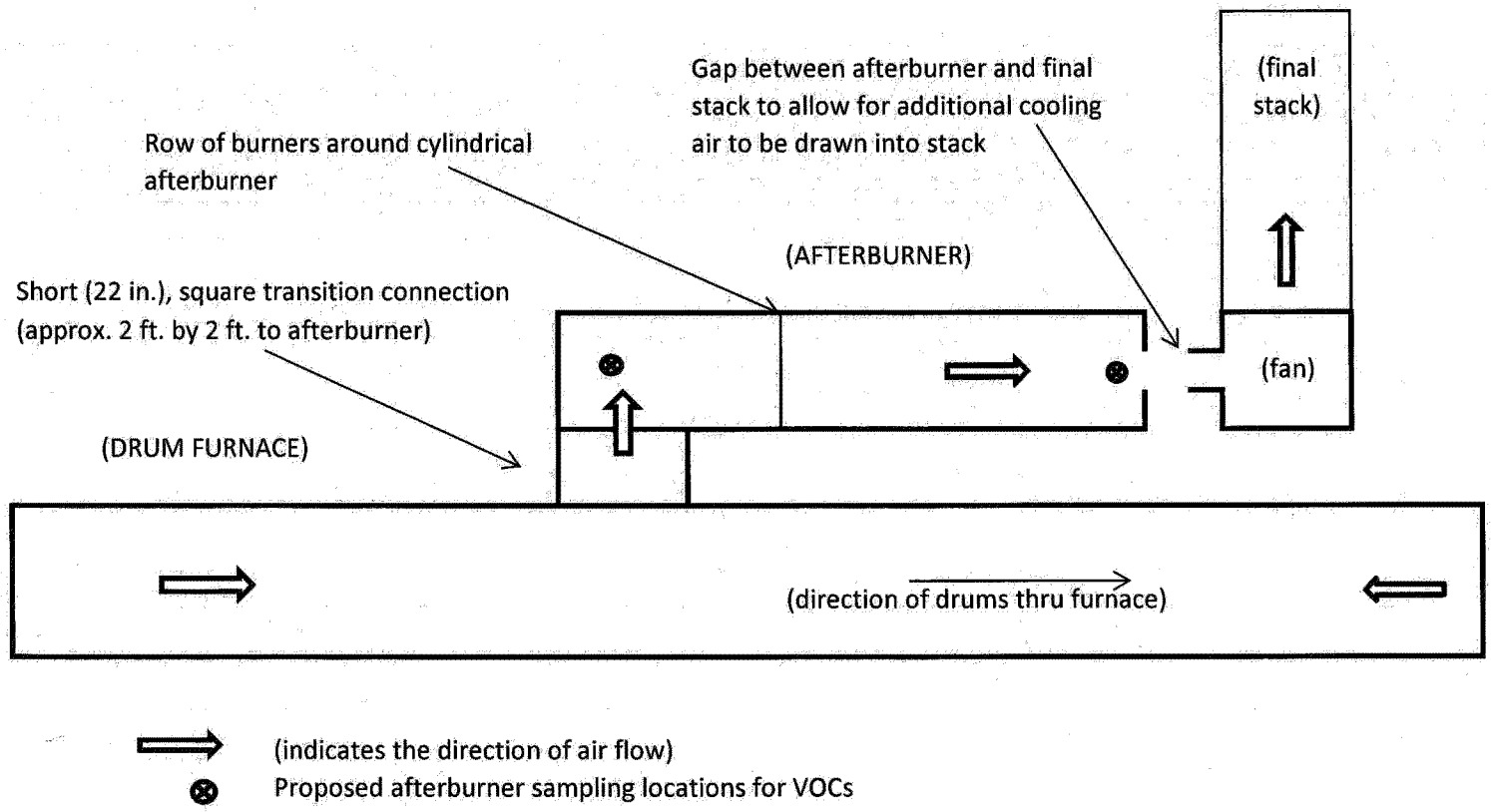


Stack Dimensions: 36 in. (wide) x 54 in. (deep)

Notes: 24 particulate sampling points on this rectangular stack; six points along each of four parallel traverses.

MID-AMERICA STEEL DRUM
DRUM RECL. AFTERBURNER (C30) - SAMPLING LOCATIONS

FIGURE 2-2



MID-AMERICA STEEL DRUM **STACK S10** **6/6/2014** **TABLE 2-1**

TEST NO.	1			
BAROMETRIC PRESSURE	29.27	IN HG		
TIP DIAMETER	0.188	IN		
STACK DIMENSIONS	36	IN	54	IN
STACK AREA	13.500	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	24			
METER VOLUME	34.19	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.009			
PARTICULATE COLLECTED	0.0191	GRAMS		
WATER COLLECTED	16	ML		
STATIC PRESSURE	-0.53	IN H2O		

ORSAT RESULTS

CO2	**O2**	**CO**	**N2**
1.40%	19.10%	0.00%	79.50%

TEST POINT	**STACK TEMP** DEG F	**PITOT DEL P** IN H2O	**ORIFICE DEL P** IN H2O	**METER TEMP** DEG F	**STACK VELOCITY** AFPS
1	380	1.20	0.42	70	78.65
2	382	1.35	0.47	72	83.52
3	385	1.25	0.44	74	80.51
4	385	1.10	0.39	75	75.52
5	384	0.95	0.33	75	70.14
6	380	0.90	0.32	76	68.11
7	380	1.35	0.47	79	83.42
8	375	1.50	0.53	80	87.67
9	376	1.35	0.47	82	83.22
10	375	1.15	0.40	85	76.76
11	374	1.05	0.37	87	73.31
12	372	1.00	0.35	88	71.45
13	371	1.30	0.46	90	81.42
14	377	1.40	0.49	92	84.80
15	375	1.35	0.47	94	83.17
16	372	1.20	0.42	95	78.27
17	372	1.00	0.35	97	71.45
18	375	0.95	0.33	99	69.77
19	365	1.55	0.54	101	88.58
20	362	1.60	0.56	103	89.84
21	360	1.35	0.47	104	82.42
22	361	1.25	0.44	105	79.36
23	362	1.10	0.39	106	74.49
24	362	1.00	0.35	107	71.02
AVERAGE	373		0.43	89	78.62

DRY STANDARD VOLUME	33.86	SCF
PERCENT WATER VAPOR	2.18	% VOL
FLOW RATE	63683	ACFM
	38559	DSCFM
	65519	M3/HR
PARTICULATE CONCENTRATION	0.0087	GR/DSCF
PARTICULATE EMISSION RATE	2.91	LB/HR
LB PART PER 1000 LB GAS	0.017	
ISOKINETIC PERCENT	102.5	

MID-AMERICA STEEL DRUM **STACK S10** **6/6/2014** **TABLE 2-2**

TEST NO.	2			
BAROMETRIC PRESSURE	29.27	IN HG		
TIP DIAMETER	0.250	IN		
STACK DIMENSIONS	36	IN	54	IN
STACK AREA	13.500	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	24			
METER VOLUME	55.65	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.009			
PARTICULATE COLLECTED	0.0235	GRAMS		
WATER COLLECTED	16	ML		
STATIC PRESSURE	-0.56	IN H2O		

ORSAT RESULTS

CO2	**O2**	**CO**	**N2**
1.20%	19.20%	0.00%	79.60%

TEST POINT	**STACK TEMP** DEG F	**PITOT DEL P** IN H2O	**ORIFICE DEL P** IN H2O	**METER TEMP** DEG F	**STACK VELOCITY** AFPS
1	360	1.40	1.40	100	83.84
2	360	1.40	1.40	101	83.84
3	359	1.30	1.30	103	80.74
4	358	1.15	1.15	105	75.90
5	358	1.05	1.05	106	72.52
6	357	0.95	0.95	107	68.94
7	360	1.55	1.55	109	88.22
8	361	1.35	1.35	109	82.38
9	362	1.30	1.30	110	80.89
10	363	1.15	1.15	110	76.13
11	362	1.00	1.00	111	70.95
12	359	0.95	0.95	112	69.02
13	355	1.45	1.45	113	85.07
14	352	1.30	1.30	115	80.40
15	352	1.20	1.20	116	77.24
16	353	1.05	1.05	117	72.30
17	351	1.05	1.05	118	72.21
18	350	0.95	0.95	119	68.64
19	350	1.35	1.35	121	81.83
20	352	1.25	1.25	122	78.84
21	354	1.20	1.20	123	77.34
22	355	1.10	1.10	123	74.09
23	354	1.00	1.00	124	70.60
24	351	0.90	0.90	124	66.85
AVERAGE	356		1.18	113	76.62

DRY STANDARD VOLUME	55.38	SCF
PERCENT WATER VAPOR	1.34	% VOL
FLOW RATE	62059	ACFM
	38694	DSCFM
	65749	M3/HR
PARTICULATE CONCENTRATION	0.0065	GR/DSCF
PARTICULATE EMISSION RATE	2.11	LB/HR
LB PART PER 1000 LB GAS	0.012	
ISOKINETIC PERCENT	94.5	

MID-AMERICA STEEL DRUM **STACK S10** **6/6/2014** **TABLE 2-3**

TEST NO.	1			
BAROMETRIC PRESSURE	29.27	IN HG		
TIP DIAMETER	0.250	IN		
STACK DIMENSIONS	36	IN	54	IN
STACK AREA	13.500	FT3		
SAMPLING TIME PER POINT	2.5	MIN		
NUMBER OF POINTS	24			
METER VOLUME	56.54	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.009			
PARTICULATE COLLECTED	0.0208	GRAMS		
WATER COLLECTED	18	ML		
STATIC PRESSURE	-0.69	IN H2O		

ORSAT RESULTS

CO2	**O2**	**CO**	**N2**
1.20%	19.20%	0.00%	79.60%

TEST POINT	**STACK TEMP** DEG F	**PITOT DEL P** IN H2O	**ORIFICE DEL P** IN H2O	**METER TEMP** DEG F	**STACK VELOCITY** AFPS
1	370	1.45	1.45	105	85.88
2	367	1.40	1.40	105	84.20
3	366	1.30	1.30	106	81.09
4	365	1.20	1.20	108	77.86
5	362	1.10	1.10	108	74.41
6	360	1.00	1.00	109	70.86
7	362	1.55	1.55	110	88.33
8	363	1.45	1.45	111	85.48
9	361	1.30	1.30	112	80.84
10	360	1.20	1.20	114	77.62
11	360	1.10	1.10	116	74.32
12	360	0.95	0.95	116	69.07
13	360	1.45	1.45	116	85.33
14	363	1.30	1.30	117	80.94
15	365	1.25	1.25	118	79.47
16	363	1.25	1.25	118	79.37
17	362	1.15	1.15	118	76.08
18	361	1.05	1.05	119	72.65
19	362	1.35	1.35	120	82.43
20	362	1.30	1.30	120	80.89
21	363	1.20	1.20	120	77.77
22	362	1.15	1.15	120	76.08
23	360	0.95	0.95	121	69.07
24	360	0.85	0.85	121	65.33
AVERAGE	362		1.22	115	78.14

DRY STANDARD VOLUME	56.28	SCF
PERCENT WATER VAPOR	1.48	% VOL
FLOW RATE	63294	ACFM
	39093	DSCFM
	66427	M3/HR
PARTICULATE CONCENTRATION	0.0057	GR/DSCF
PARTICULATE EMISSION RATE	1.86	LB/HR
LB PART PER 1000 LB GAS	0.011	
ISOKINETIC PERCENT	95.0	

VOCS - TEST 1 **TABLE 2-4**
STACK S10 - DRUM RECLAM FURNACE & AFTERBURNER
MID-AMERICA STEEL DRUM - OAK CREEK, WI

JUNE 6, 2014

INLET

TIME	VOC PPM	TIME	VOC PPM
1	21.6	31	21
2	21.1	32	26.1
3	20.8	33	32.9
4	15.1	34	33.4
5	11.5	35	42.4
6	11.6	36	39
7	26.5	37	46.8
8	60.3	38	40.6
9	63.2	39	45.2
10	50.6	40	59.5
11	71.7	41	35.5
12	67.1	42	36.8
13	48.4	43	31.8
14	28.2	44	12.4
15	56.2	45	14.2
16	22.3	46	21.3
17	26.7	47	28.3
18	19.4	48	37.8
19	34.5	49	64.6
20	38.6	50	61.1
21	47.9	51	44.2
22	58.3	52	43.3
23	54.6	53	36.1
24	50.9	54	33.4
25	29.4	55	14.4
26	26.5	56	21.8
27	33.4	57	53
28	17.8	58	18
29	14.2	59	17.2
30	25.2	60	12.8

OUTLET

TIME	VOC PPM	TIME	VOC PPM
1	2.5	31	1.7
2	3.2	32	1.5
3	2.4	33	1.5
4	2.6	34	1.6
5	3.5	35	1.6
6	3.4	36	1.5
7	3.0	37	1.6
8	1.8	38	1.4
9	1.9	39	1.7
10	2.0	40	1.4
11	1.8	41	1.6
12	2.1	42	1.8
13	2.3	43	1.3
14	2.2	44	1.5
15	2.4	45	1.3
16	2.1	46	1.2
17	2.2	47	1.4
18	1.8	48	1.3
19	1.8	49	1.6
20	1.8	50	1.4
21	2.0	51	1.3
22	2.3	52	1.3
23	2.4	53	1.2
24	2.1	54	1.6
25	1.8	55	1.3
26	1.6	56	1.3
27	1.6	57	1.3
28	1.7	58	1.3
29	1.7	59	1.9
30	1.8	60	1.5

AVG TOTAL VOC	**35.0**	**PPM**	**AVG TOTAL VOC**	**1.8**	**PPM**
METHANE (AS PROP.)	**14.5**	**PPM**	**METHANE (AS PROP.)**	**1.2**	**PPM**
TGNMO (ACTUAL)	**20.5**	**PPM**	**TGNMO (ACTUAL)**	**0.6**	**PPM**
MOISTURE IN SAMPLE	**4.7**	**%**	**MOISTURE IN SAMPLE**	**4.1**	**%**
TGNMO (DRY)	**21.5**	**PPM**	**TGNMO (DRY)**	**0.7**	**PPM**
TGNMO (AS CARBON)	**32.2**	**MG/M3**	**TGNMO (AS CARBON)**	**1.0**	**MG/M3**
TGNMO (AS PROPANE)	**39.4**	**MG/M3**	**TGNMO (AS PROPANE)**	**1.2**	**MG/M3**

TGNMO CONCENTRATION-BASED
DESTRUCTION EFFICIENCY **96.95** **%**

VOCS - TEST 2 **TABLE 2-5**
STACK S10 - DRUM RECLAM FURNACE & AFTERBURNER
MID-AMERICA STEEL DRUM - OAK CREEK, WI

JUNE 6, 2014

INLET

TIME	VOC PPM	TIME	VOC PPM
1	28.7	31	23.2
2	67.7	32	28.7
3	97.8	33	30.5
4	71.0	34	21.3
5	56.4	35	18.1
6	50.3	36	30.3
7	23.5	37	24.5
8	27.9	38	22.2
9	56.6	39	31.8
10	44.6	40	42.3
11	38.8	41	52.1
12	28.1	42	48.1
13	27.8	43	81.7
14	29.5	44	83.9
15	28.7	45	27.8
16	32.1	46	76.6
17	20.1	47	78.1
18	21.8	48	70.6
19	19.5	49	65.8
20	49.2	50	75
21	30.2	51	57.4
22	17.2	52	58.6
23	21.4	53	54.8
24	15.4	54	59.6
25	13.9	55	52.3
26	22.2	56	56.2
27	38.3	57	75.4
28	45.2	58	90.9
29	45.8	59	86.7
30	53.7	60	83.6

OUTLET

TIME	VOC PPM	TIME	VOC PPM
1	2.9	31	1.4
2	3.1	32	1.6
3	3.5	33	1.4
4	3.1	34	1.5
5	2.8	35	1.8
6	2.6	36	2.1
7	2.9	37	2.3
8	2.0	38	1.8
9	2.1	39	1.5
10	2.1	40	1.2
11	2.0	41	1.2
12	2.3	42	1.1
13	2.2	43	1.5
14	2.1	44	1.2
15	2.1	45	1.0
16	1.8	46	1.4
17	1.8	47	1.0
18	1.8	48	1.0
19	1.7	49	1.4
20	1.8	50	1.1
21	1.7	51	1.1
22	1.9	52	1.4
23	1.7	53	1.0
24	1.6	54	1.6
25	1.5	55	1.2
26	1.8	56	1.0
27	1.8	57	1.1
28	1.9	58	1.3
29	1.9	59	1.3
30	1.7	60	1.1

AVG TOTAL VOC	**45.5**	**PPM**	**AVG TOTAL VOC**	**1.7**	**PPM**
METHANE (AS PROP.)	**17.2**	**PPM**	**METHANE (AS PROP.)**	**1.4**	**PPM**
TGNMO (ACTUAL)	**28.3**	**PPM**	**TGNMO (ACTUAL)**	**0.3**	**PPM**
MOISTURE IN SAMPLE	**4.7**	**%**	**MOISTURE IN SAMPLE**	**4.1**	**%**
TGNMO (DRY)	**29.7**	**PPM**	**TGNMO (DRY)**	**0.4**	**PPM**
TGNMO (AS CARBON)	**44.5**	**MG/M3**	**TGNMO (AS CARBON)**	**0.5**	**MG/M3**
TGNMO (AS PROPANE)	**54.5**	**MG/M3**	**TGNMO (AS PROPANE)**	**0.7**	**MG/M3**

TGNMO CONCENTRATION-BASED
DESTRUCTION EFFICIENCY **98.78** **%**

VOCS - TEST 3 **TABLE 2-6**
STACK S10 - DRUM RECLAM FURNACE & AFTERBURNER
MID-AMERICA STEEL DRUM - OAK CREEK, WI

JUNE 6, 2014

INLET

TIME	VOC PPM	TIME	VOC PPM
1	15.4	31	32.4
2	23.4	32	59.8
3	32.6	33	62.5
4	31.8	34	66.3
5	59.8	35	30.5
6	48.6	36	22.9
7	41.8	37	19.5
8	60.8	38	19.9
9	63.9	39	20.3
10	38.2	40	13.5
11	34.0	41	44
12	32.6	42	30.6
13	36.5	43	42.2
14	30.2	44	39.9
15	26.2	45	34.1
16	20.4	46	20.5
17	15.9	47	20.6
18	14.3	48	16.3
19	12.6	49	34
20	17.4	50	34.1
21	39.9	51	45.5
22	42.4	52	36.4
23	44.1	53	49.3
24	32.8	54	48.6
25	36.6	55	60.4
26	43.8	56	75
27	50.1	57	50.7
28	45.8	58	62.2
29	69.7	59	69.2
30	73.6	60	62.2

OUTLET

TIME	VOC PPM	TIME	VOC PPM
1	1.0	31	0.3
2	0.8	32	0.4
3	0.7	33	0.5
4	0.6	34	0.3
5	0.9	35	0.3
6	0.7	36	0.4
7	0.8	37	0.6
8	0.7	38	0.4
9	0.6	39	0.4
10	0.7	40	0.3
11	0.7	41	0.5
12	0.8	42	0.4
13	0.7	43	0.3
14	0.6	44	0.3
15	0.7	45	0.3
16	0.5	46	0.3
17	0.5	47	0.3
18	0.5	48	0.7
19	0.4	49	0.9
20	0.4	50	1.2
21	0.4	51	0.8
22	0.4	52	0.6
23	0.4	53	0.5
24	0.3	54	0.5
25	0.2	55	1.1
26	0.4	56	0.7
27	0.4	57	0.4
28	0.4	58	0.4
29	0.4	59	0.8
30	0.4	60	0.5

AVG TOTAL VOC	**39.3**	**PPM**	**AVG TOTAL VOC**	**0.5**	**PPM**
METHANE (AS PROP.)	**16.1**	**PPM**	**METHANE (AS PROP.)**	**0.2**	**PPM**
TGNMO (ACTUAL)	**23.2**	**PPM**	**TGNMO (ACTUAL)**	**0.3**	**PPM**
MOISTURE IN SAMPLE	**4.7**	**%**	**MOISTURE IN SAMPLE**	**4.1**	**%**
TGNMO (DRY)	**24.4**	**PPM**	**TGNMO (DRY)**	**0.4**	**PPM**
TGNMO (AS CARBON)	**36.5**	**MG/M3**	**TGNMO (AS CARBON)**	**0.5**	**MG/M3**
TGNMO (AS PROPANE)	**44.7**	**MG/M3**	**TGNMO (AS PROPANE)**	**0.7**	**MG/M3**

TGNMO CONCENTRATION-BASED
DESTRUCTION EFFICIENCY **98.54** **%**

3.0 TEST METHODS

3.1 Particulate Matter Testing

The equipment used to sample for particulate matter was the Western Precipitation Division of the Joy Manufacturing Company Emission Parameter Analyzer. Samples were collected and analyzed in accordance with procedures outlined in EPA Method 5 - "Determination of Particulate Emissions from Stationary Sources" as found in 40 CFR Part 60, Appendix A, and EPA Method 202 - "Determination of Condensable Particulate Emissions from Stationary Sources" as found in 40 CFR Part 51, Appendix M.

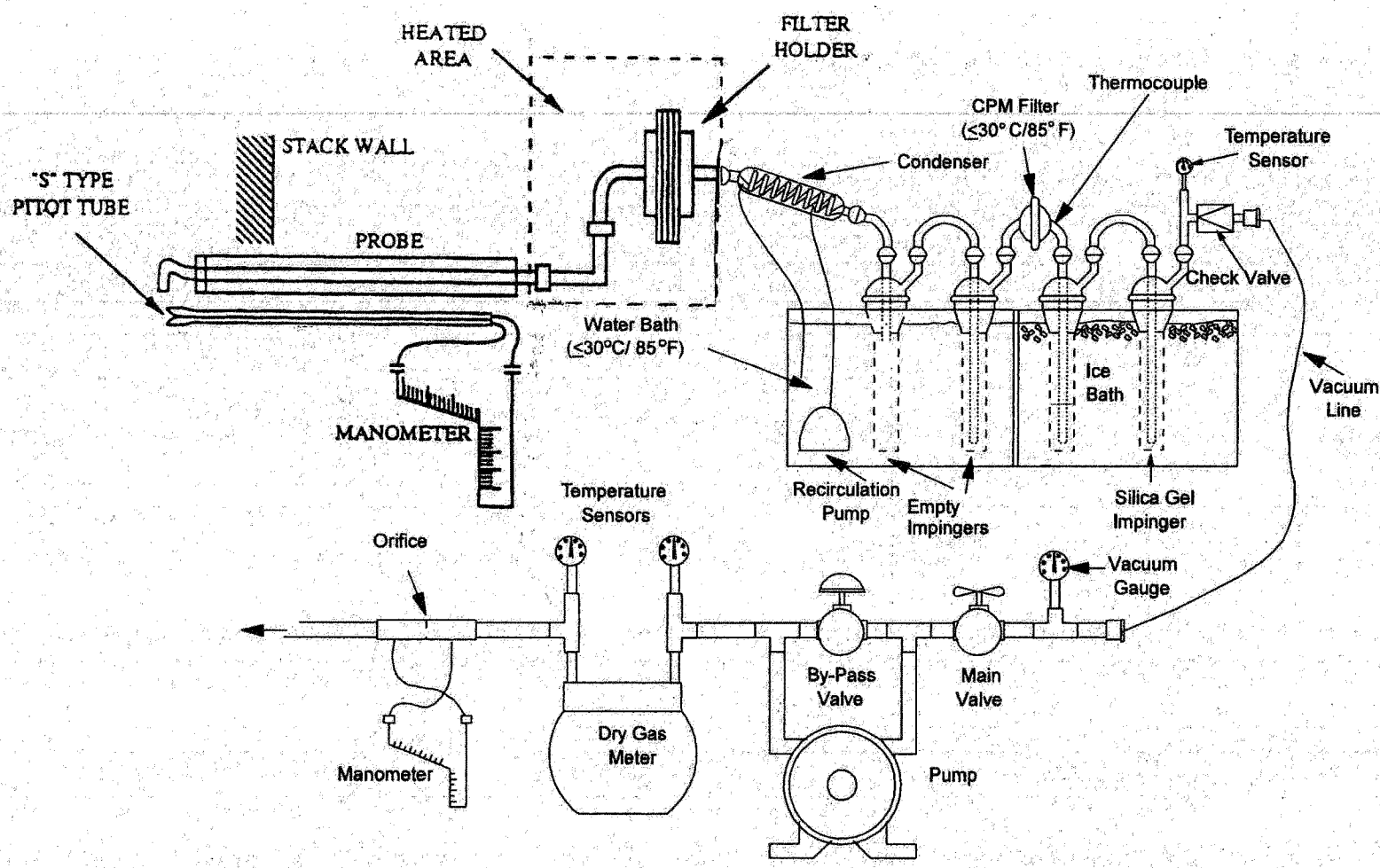
The "front half" of the sampling train consisted of a stainless steel probe tip, a heated stainless steel lined probe, and a heated glass fiber filter (or "filterable particulate" filter). Following the front half, the "back half" of the sampling train consisted of a moisture condenser, several impingers, and a condensable particulate matter (CPM) filter. A schematic drawing of the sampling train is included. The knock-out impinger and second impinger preceding the CPM filter were left dry and were placed in a water bath. The third impinger (immediately following the CPM filter) contained 100 milliliters of de-ionized water, the fourth was left dry, and the fifth contained a tared amount of silica gel. The gas then passed through a vacuum pump, calibrated dry gas meter, and a calibrated orifice. The temperatures of the stack gas stream, as well as strategic locations within the sampling devices, were monitored by RTDs and read directly from a gauge on the control unit.

The initial gas stream velocity was obtained from a preliminary traverse using an "S" type pitot tube. The initial moisture was estimated from previous tests of similar processes. This data, along with the stack temperature, was used to set a nomograph so that rapid calculations of isokinetic sampling conditions could be made.

The principle of the method was to collect the sample representative of the exhaust by adjusting the sample collection velocity to match the exhaust gas stream velocity at the point of collection. The velocity at the point of collection was measured with an "S" type pitot tube attached to the probe and the collection velocity was matched to the stack gas velocity by adjusting the flow as indicated by the calibrated orifice.

To determine the molecular weight of the stack gas, samples were drawn into an Orsat analyzer and analyzed for percentage CO2, O2, CO, and N2.

At the completion of the test, the probe and tip preceding the filter was washed (rinsed, brushed, and rinsed three times) with acetone. This rinse was later placed in a tared beaker along with a rinse of the filter-holding glassware and evaporated to dryness at room temperature. The filter and beakers were then desiccated to the tared humidity conditions and weighed. These combined weights constituted the filterable (or "front-half") particulate catch.



Schematic of Condensable Particulate Sampling Train

3.1 (continued)

The impinger contents were measured and weighed for determination of the actual moisture content of the exhaust gas stream. Since the stack exhaust was relatively dry, no condensate formed in the knock-out or dry second impinger that preceded the CPM filter. Therefore, no purge of any condensate solution was performed (as noted in EPA Method 202). The condenser, impingers, and connecting glassware which preceded the CPM filter were rinsed with water (twice). The same glassware was then rinsed with acetone and hexane (twice). All rinses were saved for further analysis.

The CPM filter was extracted, with sonication, three times with water and then hexane. The water extractions were added to the impinger (pre CPM filter) condensate catch and rinses; the hexane extractions were added to the acetone/hexane rinses.

The impinger water catch (pre CPM filter) and rinses were then placed into large separatory funnels. An oil/grease type extraction was then performed on the impinger contents using three repeated hexane extractions. The hexane portion from the extractions was added to the previous glassware rinses and was then evaporated off at room temperature leaving any organic residue. The remaining water fraction of the extractions was boiled down to a small volume (approx. 10 ml.) and allowed to dry at room temperature for each sample catch. The remaining residue was then weighed as a measure of any inorganic particulates. The combined weights of the two extraction residues constituted the condensable (or "back-half") particulate fraction.

The combined weights of the filterable and condensable particulate catch were used to determine the total particulate emission rates. Blanks of the sample solutions were also analyzed in similar fashion to the field samples. All test results were blank subtracted as appropriate.

3.2 VOC Test Methods

Testing to determine VOC levels was performed in accordance with the procedures outlined in EPA Method 25A (40 CFR Part 60, Appendix A). Exhaust gas from each of the two sample locations was drawn through a stainless steel probe and a heated Teflon line to an identical on-site FID analyzer (Thermo Environmental Instruments Model 51A). The VOC concentrations of the sampled gas streams could be read directly from the analyzers. Readings were taken every minute and each reading represented the electronically averaged VOC concentration over the previous minute.

The analyzers were calibrated throughout the test efforts using EPA Protocol gas standards (propane in nitrogen). Calibrations were made before and after each test hour. The concentrations of the gas standards used were:

Outlets - 15.1, 25.4, and 45.4 ppm
Inlets - 25.4, 45.4, and 86.3 ppm

The certification sheets for the gas standards are included in Appendix B of this report. The calibration gases were introduced into the same sampling train (through the heated line) as the sampled exhaust gas.

3.2 VOC Test Methods (continued)

The VOC readings from the analyzers were corrected (methane levels were subtracted out) for methane levels measured in the exhaust gas streams. Since methane is exempt from the definition of VOCs, this correction was appropriate. The methane levels were determined by gas chromatograph (GC-FID, Chromosorb 102 column) from integrated Tedlar bag samples that were taken during each test period.

4.0 CALIBRATION DATA

The probe tips, pitot tubes, dry gas meters, and sample box orifices used in the test efforts were calibrated prior to the testing in accordance with the procedures outlined in the Maintenance, Calibration, and Operation of Isokinetic Source-Sampling Equipment as published by the US EPA. The values obtained were:

Stack	Date	Control Box ID	Orifice Coeff. ($\Delta H@$)	Dry Gas Meter Coeff. (γ)	Probe Tip Diameter
S10	6/6	2	0.726	1.009	0.188 in. (Test 1), 0.250 in. (Tests 2 & 3)

The flow measurements were made with an S-type pitot tube attached to the particulate sampling probe. For the sampling probe used, the pitot tube coefficient (C_p) was 0.84. Prior to the first test, the null angles were measured to verify the absence of cyclonic flow. All of the null angles were 5 degrees or less, validating the flow measurements and sampling location.

The dry gas meter installed in the control box was a temperature compensating meter. The correction factor (gamma) for the meter could best be described by the following equations:

Box 2 - $\gamma = 1.009 + [(T_M - 70) \times 0.00012]$

The most recent calibrations on the particulate sampling equipment were performed April 7, 2014.